

Appl. No. 10/609,311
Response to 8/28/2006 Office Action

In the Claims

Claim 1 (currently amended): A semiconductor processing patterning method, comprising:

forming a first resist layer over a surface of a silicon-comprising substrate;

forming a second resist layer over the first resist layer;

exposing overlapping portions of the first and second resist layers to actinic energy effective to change solubility of the exposed portions versus the unexposed portions of each of the first and second resist layers in a developer solution; and

after the exposing, developing the first and second resist layers with the developer solution to expose at least a portion of the surface of the silicon-comprising substrate, and form a mask pattern over the silicon-comprising substrate, the mask pattern comprising the first and second resist layers, wherein:

the first resist layer of the mask pattern comprises opposing sidewalls in at least one cross section, the first resist layer extending continuously between the opposing sidewalls of the first resist layer of the mask pattern;

the second resist layer of the mask pattern comprises opposing sidewalls in the one cross section, the second resist layer extending continuously between the opposing sidewalls of the second resist

Appl. No. 10/509,311
Response to 8/28/2006 Office Action

layer of the mask pattern; and

an entirety of the opposing sidewalls of the first resist layer
received laterally inward of an entirety of the opposing sidewalls of the
second resist layer in the one cross ~~section~~ section; and
after the developing, etching material of the silicon-comprising
substrate using the mask pattern as a mask.

Claim 2 (previously presented): The method of claim 1 wherein the first and
second resist layers comprise different compositions as initially formed.

Claim 3 (previously presented): The method of claim 1 wherein the first resist
layer is photosensitive to electromagnetic radiation at a wavelength of no
greater than about 325 nm.

Claim 4 (previously presented): The method of claim 1 wherein the second
resist layer is formed on the first resist layer.

Claim 5 (previously presented): The method of claim 1 wherein both the first
and second resist layers comprise negative resist.

Claim 6 (previously presented): The method of claim 1 wherein both the first
and second resist layers comprise positive resist.

Appl. No. 10/609,311
Response to 8/26/2006 Office Action

Claim 7 (original): The method of claim 1 wherein the actinic energy comprises UV radiation.

Claim 8 (original): The method of claim 1 wherein the actinic energy comprises an e-beam.

Claim 9 (previously presented): The method of claim 1 wherein the developing comprises etching an exposed portion of the first resist layer faster than an exposed portion of the second resist layer.

Claim 10 (previously presented): The method of claim 1 wherein the first resist layer comprises at least one of 1-methoxy-2-propanol and ethyl lactate and the second resist layer comprises at least one of cyclohexanone and 2-heptanone.

Claim 11 (original): The method of claim 1 wherein the developer solution comprises TMAH.

Claim 12 (previously presented): The method of claim 1 wherein the first resist layer has a thickness which is less than a thickness of the second resist layer.

Appl. No. 10/509,311

Response to 8/28/2006 Office Action

Claim 13 (previously presented): The method of claim 1 wherein the first resist layer has a thickness which is less than a total thickness of all layers received over the first resist layer.

Claim 14 (previously presented): The method of claim 1 wherein the first resist layer has a thickness which is less than or equal to about 50% of a total thickness of the first resist layer and all layers received over the first resist layer.

Claim 15 (previously presented): The method of claim 1 wherein the first resist layer has a thickness which is less than or equal to about 25% of a total thickness of the first resist layer and all layers received over the first resist layer.

Claim 16 (previously presented): The method of claim 1 wherein the first resist layer has a thickness which is less than or equal to about 10% of a total thickness of the first resist layer and all layers received over the first resist layer.

Claim 17 (previously presented): The method of claim 1 wherein the first resist layer has a thickness which is less than or equal to about 5% of a total thickness of the first resist layer and all layers received over the first resist layer.

Appl. No. 10/609,311
Response to 8/28/2006 Office Action

Claim 18 (cancelled).

Claim 19 (original): The method of claim 1 wherein the opposing sidewalls of the first resist layer are at least partially curved in the one cross section.

Claim 20 (original): The method of claim 1 wherein the opposing sidewalls of the first resist layer and the opposing sidewalls of the second resist layer are of different shapes in the one cross section.

Claim 21 (cancelled).

Appl. No. 10/609,311
Response to 8/28/2006 Office Action

Claim 22 (currently amended): A semiconductor processing patterning method, comprising:

forming a first positive resist layer over a surface of a silicon-comprising substrate;

forming a second positive resist layer over the first positive resist layer, the first and second positive resist layers being different in composition, the first positive resist layer having greater solubility in a developer solution than does the second positive resist layer at least after exposure to actinic energy effective to increase solubility of each of the first and second positive resist layers in the developer solution;

exposing overlapping portions of the first and second positive resist layers to said effective actinic energy; and

after the exposing, developing the first and second positive resist layers with the developer solution, the developing solution removing the exposed portions of the first positive resist layer at a faster rate than removing the exposed portions of the second positive resist layer effective to expose at least a portion of the surface of the silicon-comprising substrate, and form a mask pattern over the silicon-comprising substrate, the mask pattern comprising the first and second positive resist layers, wherein:

the first positive resist layer comprises opposing sidewalls in at least one cross section, the first positive resist layer extending continuously between the opposing sidewalls of the first positive resist layer of the mask pattern;

Appl. No. 10/609,311

Response to 8/28/2006 Office Action

the second positive resist layer comprises opposing sidewalls in at least the one cross section, the second positive resist layer extending continuously between the opposing sidewalls of the second positive resist layer of the mask pattern; and

at least a portion of the opposing sidewalls of the first positive resist layer of the mask pattern are recessed laterally inward of at least a portion of opposing sidewalls of the second positive resist layer in the one cross ~~section~~ section; and
after the developing, etching material of the silicon-comprising substrate using the mask pattern as a mask.

Claim 23 (original): The method of claim 22 wherein the first positive resist layer is photosensitive to electromagnetic radiation at a wavelength of no greater than about 325 nm.

Claim 24 (original): The method of claim 22 wherein the second positive resist layer is formed on the first positive resist layer.

Claim 25 (original): The method of claim 22 wherein the actinic energy comprises UV radiation.

Claim 26 (original): The method of claim 22 wherein the actinic energy comprises an e-beam.

Appl. No. 10/609,311

Response to 8/28/2006 Office Action

Claim 27 (original): The method of claim 22 wherein the first positive resist layer comprises 1-methoxy-2-propanol and the second positive resist layer comprises cyclohexanone and 2-heptanone.

Claim 28 (original): The method of claim 22 wherein the developer solution comprises TMAH.

Claim 29 (original): The method of claim 22 wherein the first positive resist layer has a thickness which is less than a thickness of the second positive resist layer.

Claim 30 (original): The method of claim 22 wherein the first positive resist layer has a thickness which is less than a total thickness of all layers received over the first positive resist layer.

Claim 31 (original): The method of claim 22 wherein the first positive resist layer has a thickness which is from about 25% to about 50% of a total thickness of the first positive resist layer and all layers received over the first positive resist layer.

Claim 32 (original): The method of claim 22 wherein the first positive resist layer has a thickness which is from about 5% to about 10% of a total thickness of the first positive resist layer and all layers received over the first positive resist layer.

Appl. No. 10/609,311
Response to 8/28/2006 Office Action

Claim 33 (original): The method of claim 22 wherein the first positive resist layer has a thickness which is less than about 5% of a total thickness of the first positive resist layer and all layers received over the first positive resist layer.

Claim 34 (cancelled).

Claim 35 (original): The method of claim 22 wherein the opposing sidewalls of the first positive resist layer are at least partially curved in the one cross section.

Claim 36 (original): The method of claim 22 wherein an entirety of the opposing sidewalls of the first positive resist layer are recessed laterally inward of the opposing sidewalls of the second positive resist layer in the one cross section.

Appl. No. 10/609,311
Response to 8/28/2006 Office Action

Claim 37 (currently amended): A semiconductor processing patterning method, comprising:

forming a first composition resist layer over a surface of a silicon-comprising substrate;

forming a second composition resist layer over the first composition resist layer;

exposing overlapping portions of the first and second composition resist layers to actinic energy effective to initiate formation of a mask pattern having a second mask block over a first mask block, wherein the solubility of the first mask block is greater than the solubility of the second mask block in a developer solution; and

developing the first and second composition resist layers with the developer solution under conditions effective to remove the material of the first mask block at a faster rate than removing the material of the second mask block, the developing exposing at least a portion of the surface of the silicon-comprising substrate, and forming the mask ~~pattern~~ pattern; and

after the developing, etching material of the silicon-comprising substrate using the mask pattern as a mask.

Claim 38 (original): The method of claim 37 wherein the first composition resist layer is photosensitive to electromagnetic radiation at a wavelength of no greater than about 325 nm.

Appl. No. 10/809,311

Response to 8/28/2006 Office Action

Claim 39 (original): The method of claim 37 wherein the second composition resist layer is formed on the first composition resist layer.

Claim 40 (original): The method of claim 37 wherein the second mask block is formed on the first mask block.

Claim 41 (original): The method of claim 37 wherein the actinic energy comprises UV radiation.

Claim 42 (original): The method of claim 37 wherein the actinic energy comprises an e-beam.

Claim 43 (original): The method of claim 37 wherein both the first composition resist layer and the second composition resist layer comprise negative resist.

Claim 44 (original): The method of claim 37 wherein both the first composition resist layer and the second composition resist layer comprise positive resist.

Claim 45 (original): The method of claim 37 wherein the first composition resist layer comprises 1-methoxy-2-propanol and the second composition resist-layer comprises cyclohexanone and 2-heptanone.

Appl. No. 10/609,311

Response to 8/28/2006 Office Action

Claim 46 (original): The method of claim 37 wherein the developer solution comprises TMAH.

Claim 47 (original): The method of claim 37 wherein the first mask block has a thickness which is less than a thickness of the second mask block.

Claim 48 (original): The method of claim 37 wherein the first composition resist layer has a thickness which is less than a total thickness of all layers received over the first composition resist layer.

Claim 49 (original): The method of claim 37 wherein the first composition resist layer has a thickness which is less than or equal to about 50% of a total thickness of the first composition resist layer and all layers received over the first composition resist layer.

Claim 50 (original): The method of claim 37 wherein the first composition resist layer has a thickness which is less than or equal to about 25% of a total thickness of the first composition resist layer and all layers received over the first composition resist layer.

Claim 51 (original): The method of claim 37 wherein the first composition resist layer has a thickness which is less than or equal to about 10% of a total thickness of the first composition resist layer and all layers received over the first composition resist layer.

Appl. No. 10/509,311
Response to 8/28/2005 Office Action

Claim 52 (original): The method of claim 37 wherein the first composition resist layer has a thickness which is less than or equal to about 5% of a total thickness of the first composition resist layer and all layers received over the first composition resist layer.

Claim 53 (previously presented): The method of claim 37 wherein:

the first mask block of the mask pattern comprises opposing sidewalls in at least one cross section, the first mask block extending continuously between the opposing sidewalls;

the second mask block of the mask pattern comprises opposing sidewalls in at least the one cross section, the second mask block extending continuously between the opposing sidewalls of the second mask block; and

at least a portion of the opposing sidewalls of the first mask block are recessed laterally inward of at least a portion of the opposing sidewalls of the second mask block in the one cross section.

Claim 54 (original): The method of claim 53 wherein the opposing sidewalls of the first mask block are at least partially curved in the one cross section.

Claim 55 (original): The method of claim 53 wherein the opposing sidewalls of the first mask block and the opposing sidewalls of the second mask block are of different shapes in the one cross section.

Appl. No. 10/609,311
Response to 8/28/2006 Office Action

Claim 56 (original): The method of claim 53 wherein an entirety of the opposing sidewalls of the first mask block in the one cross section are recessed laterally inward of the opposing sidewalls of the second mask block in the one cross section.

Claim 57-70 (cancelled).

Claim 71 (currently amended): The method of claim 20 wherein the opposing sidewalls of the first resist layer extend from the second resist layer to ~~the~~ the surface of the silicon-comprising substrate in the one cross section.

Claim 72 (previously presented): The method of claim 71 wherein the opposing sidewalls of the first resist layer are at least partially curved in the one cross section.